Interior noise and electric vehicles - an experimental survey

Richard Cornish BCU

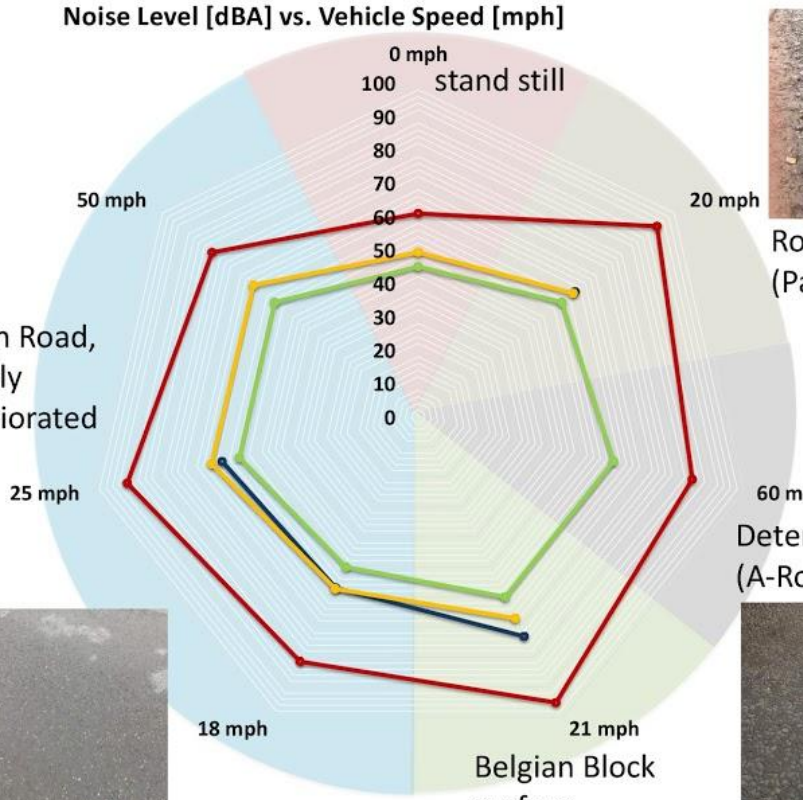
BIRMINGHAM CITY University

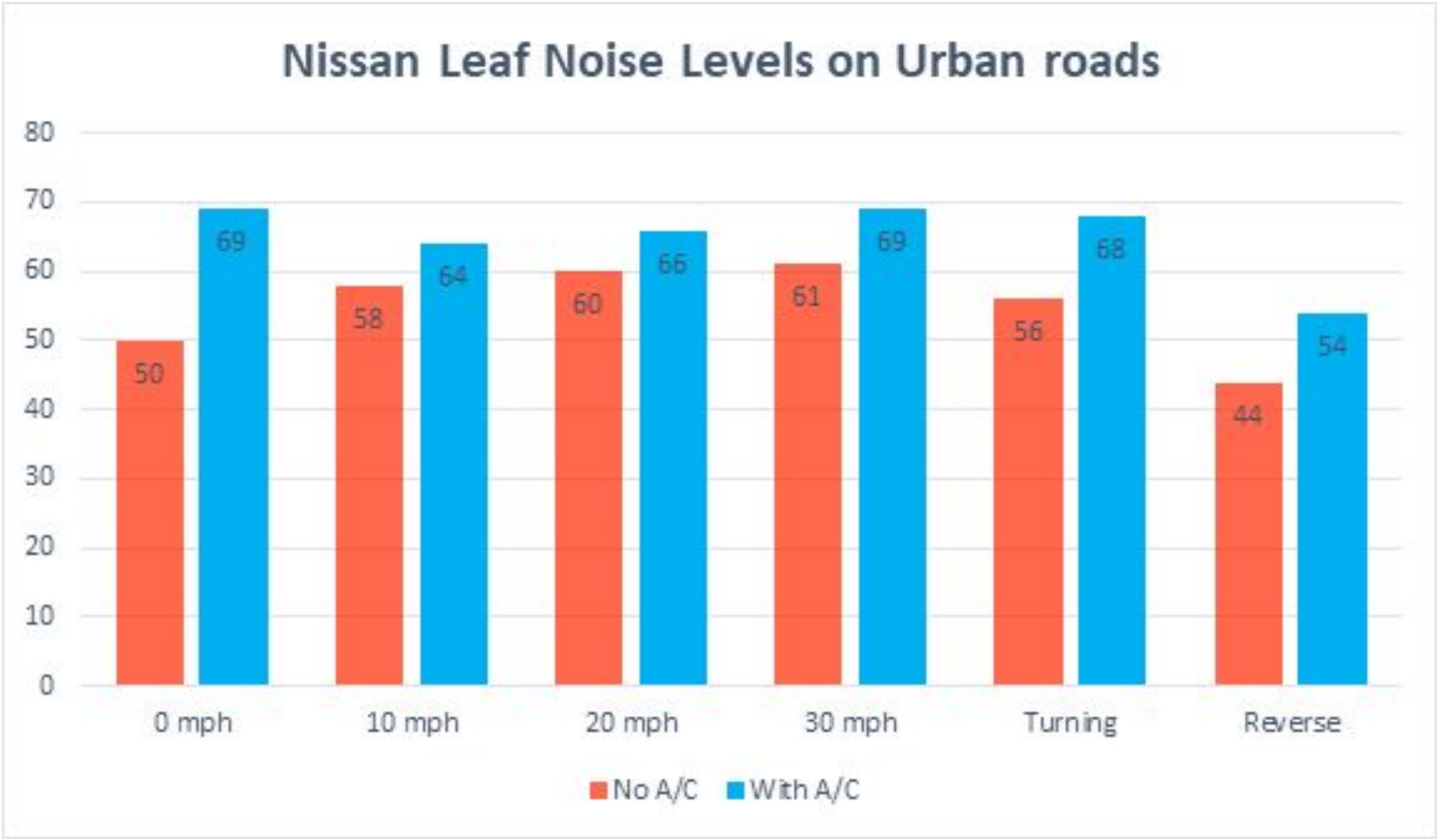
Nissan Leaf

Toyota Yaris

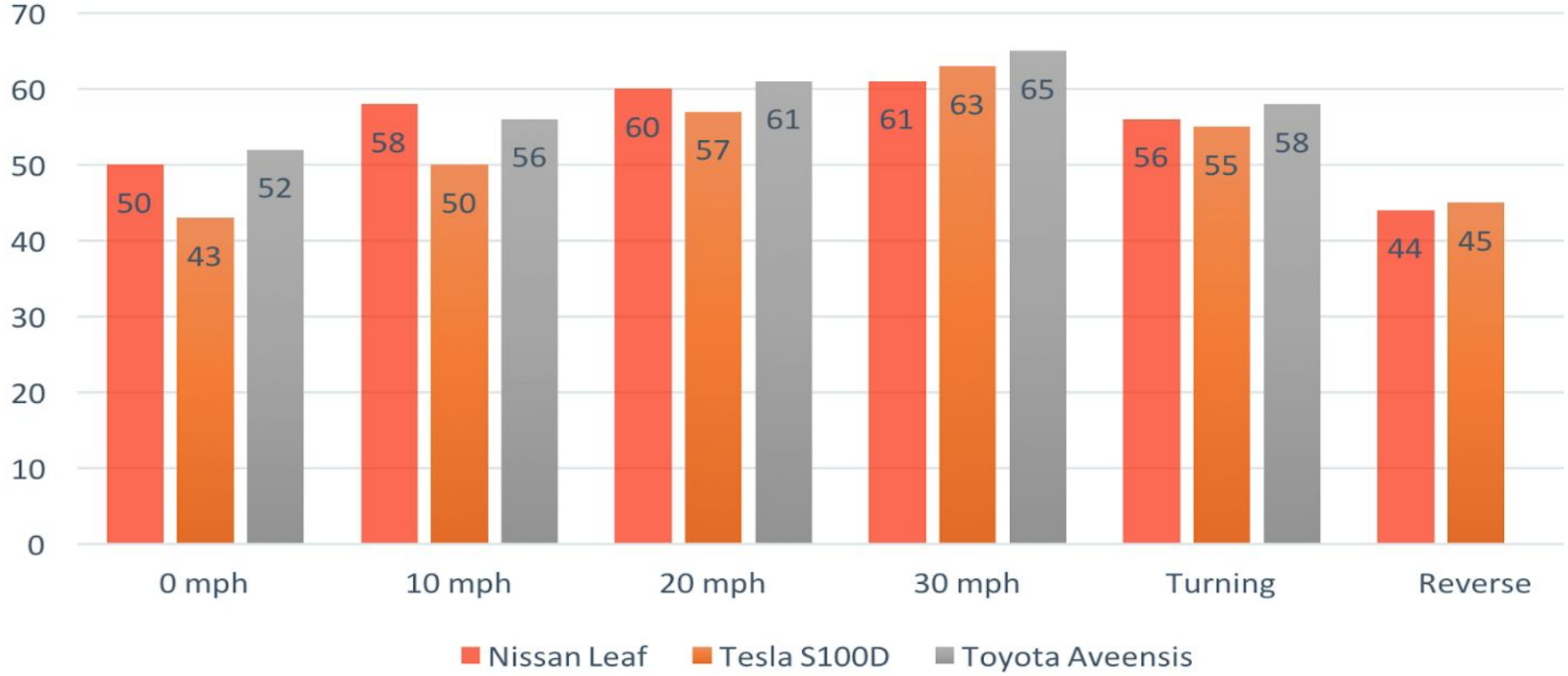
Tesla Model X

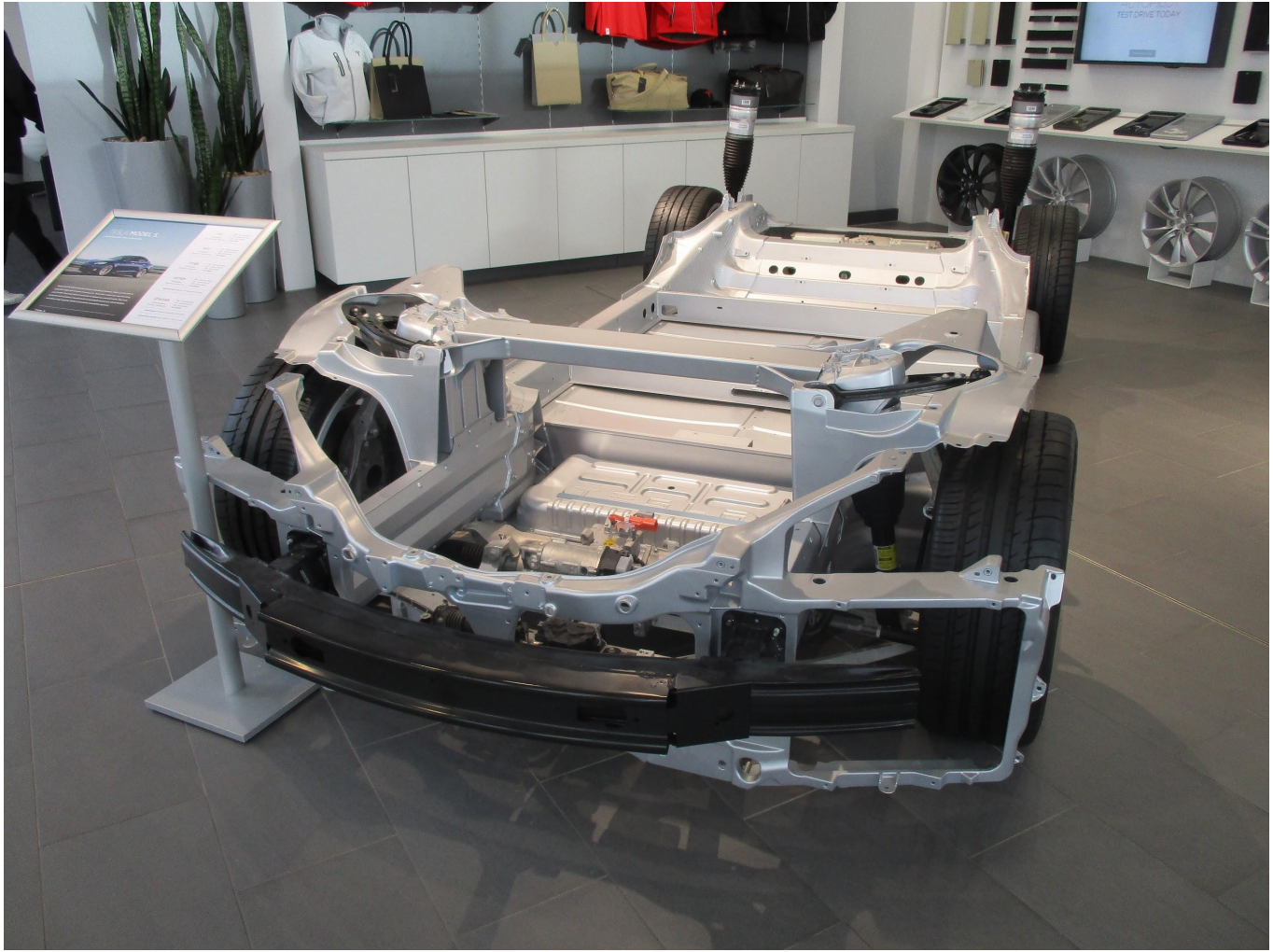
BMW 3 Series




Nissan Leaf Noise Levels on Urban roads
80
70
60
50
40
30
20
10
0
50
69
58
64
60
66
61
69
56
68
44
54
0 mph
10 mph
20 mph
30 mph
Turning
Reverse
No A/C
With A/C

Noise Levels on Urban roads

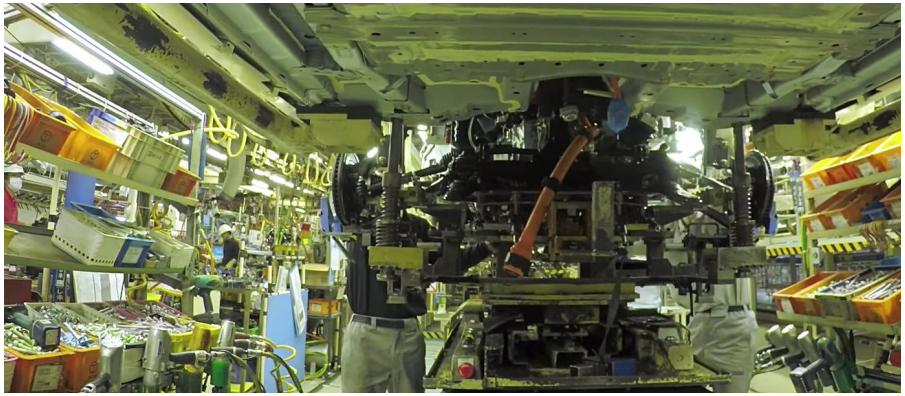


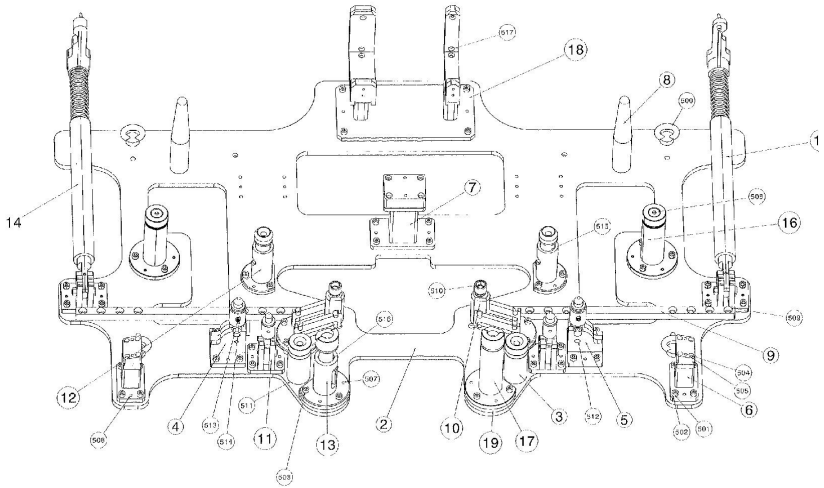

TEST DRIVE TODAY

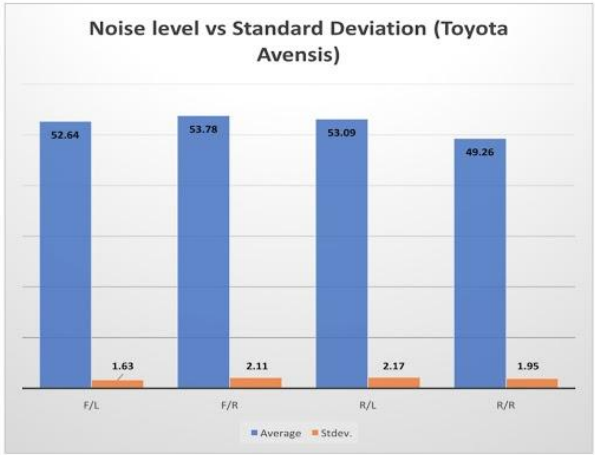
Electric vehicles are 50% heavier.

Tyre noise increases with load + 3 dB.

Tyre noise increases with pressure + 3dB




14
1
18
8
7
16
12
9
6
4
11
13
2
10
19
17
3
5


Noise level vs Standard Deviation (Toyota Avensis)
52.64
1.63
53.78
2.11
53.09
2.17
49.26
1.95
F/L
F/R
R/L
R/R
Average
Stdev.

Electric vehicles are competing with premium vehicles and owners expect very low noise levels and negligible servicing needs.

The best electric vehicles have unique air spring chassis and tyre technology to produce a ‘quiet ride’. The target is ‘Quiet Ride’.

Constant speed testing is appropriate. You can always find a bad road surface.

The battery compartment modifies the modal response of the steel car body to low frequency vibration and noise paths.

The mainstream electric vehicle is a steel bodied SUV with high pressure tyres.

Subframe isolation is the main barrier to interior road noise. Noise path quality and consistency is built by robotic assembly by BCU student at NMUK. Noise path quality is being monitored at BCU.

References

Influence of measuring conditions on tyre/road noise, EuroRegio2016, June 13-15, Porto, Portugal

Dennis Lausecker, T A Naveen Krishna, Prince Pathania, Anirudh Swaminathan and Richard Cornish, Target Setting for Interior Noise in Advanced Powertrain Vehicles, FPC 2017 Future Powertrain Conference, March 2017.

Rashid R, Langley R S, Cornish R H, 'Modelling and analysis of in-vehicle boom noise', Proceedings of the Institute of Acoustics, Vol. 26. Pt.2 2004

PhD Thesis: 'An Investigation of the Role of Vehicle Body Variability in Interior Noise Variability of Light Commercial Vehicles', University of Central England 1998.

A small group investigated tyre noise inside electric and IC vehicles on inner city roads and some major A roads.

The methodology focussed on comparing interior noise levels over road surfaces ranging from cobblestones to good and pitted tarmac. Vehicles were also compared qualitatively.

In common with other workers we found that the noise levels varied strongly with the road type. Electric vehicles were about 50% heavier than the IC vehicles, with tyre pressures about 50% higher.

Except for the most expensive battery electric vehicles, we found instances of much higher interior road noise. Our conclusion is that mainstream budget EVs risk becoming unpopular in cities due to poor levels of refinement.